OBSERVATIONS ON COLONIES AND ON SEEDLING GROWTH OF APPARENT HYBRIDS BETWEEN *ERYTHRONIUM ALBIDUM* AND *E. PROPULLANS*

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ABSTRACT

Two colonies of apparent hybrids between *Erythronium albidum* and *E. propullans* are described, one colony mostly like *E. propullans* but with some characters of *E. albidum*, the other the reverse. Seeds from *E. propullans* of probable hybrid origin were planted and the resulting seedlings grown for 6-8 years, with great attrition. Non-flowering bulbs of these plants occasionally divided, a trait of *E. albidum*. One plant has bloomed to date, showing hybrid characters but lacking the offshoot of *E. propullans*. Occasional dormancy of transplanted bulbs was noted. Figures on bulb multiplication are given.

While studying *Erythronium propullans* Gray and *E. albidum* Nutt. in the field in 1980 the author discovered a hillside with several colonies that appeared to be hybrids between these species. Two of these colonies were studied in some detail, and are reported on here. The hillside is the north-facing slope of a bluff overlooking the Cannon River in Rice County, Minnesota; its general legal description is T 110 N, R 20 W, S 1/2 SE 1/4 sec. 17. The site is in the north-central part of this tract; its owner is D. Borgstahl.

The first colony is near the top of the slope. Approached from above, it was conspicuous by its violet flowers. Examination of the plants suggested a possible hybrid origin, so they were studied further. (See Banks, 1980 and Morley, 1978, 1982 for morphological distinguishing characters of the two species.) Most of their characteristics were those of *E. propullans:* the stems of the flowering plants bore offshoots; the tips of the leaves of the flowering plants had narrow angles; 42% of the

plants in the colony were flowering; and the flowers were frequently tetramerous. However, the blooming time was synchronous with that of the *E. albidum* colonies in the vicinity, not with those of *E. propullans;* the large leaves were the size of *E. albidum* leaves; and the non-flowering plants that were dug bore rapidly growing runners, often two each. The tepals and peduncles were intermediate in length. The light violet to pink violet tepals I have not seen in either species.

When the same colony was visited in 1988 it appeared much the same but no non-flowering plants with runners were found. Whether due to the previous dry winter and spring or some other cause is unknown.

The second colony, a small one, was situated part way down the slope and appeared in all respects to be typical of *E. albidum*, even on close inspection. Leaf size, runner formation from the non-flowering bulbs, peduncle length, tepal color and size were unquestionable. However, the proportion of flowering to non-flowering plants seemed unduly high for the species, so a count was made. 27% of the plants were in bloom, a number typical of *E. propullans* but outside the range for *E. albidum* which is 1-10. The range for *E. propullans* is 11-51. At first the 27% was taken as an extension of the range of that feature for *E. albidum*. However, while digging to check the runners it was discovered that each flowering stem bore a small rudimentary offshoot ca. 3-5 mm long. This can only mean that some genes of *E. propullans* were present, thus accounting for the high proportion of flowering plants as well as the abortive offshoot. Offshoots of *E. propullans* at this time had well-developed runners. The general resemblance of the plants to those of *E. albidum* gave the impression that the colony represented some stage in introgression from *E. propullans*. When searched for in 1988, this colony could not be found, although there were a few non-flowering plants in the vicinity.

Previously (1982) the author pointed out that the flowering frequencies of *E. albidum* he encountered in the range of *E. propullans* were much higher than those cited by others for other states. It appears possible that introgression from *E. propullans* is responsible for the difference. Banks (1980) pointed

out that *E. albidum* is 73% fertile when pollinated with *E. propullans* pollen, so there would appear to be ample opportunity for introgression. Banks found that plants of *E. propullans* rarely if ever form seed when pollinated by their own pollen, whether selfed or outcrossed to other clones or populations; however, she did demonstrate 20% fertility when pollen of *E. albidum* was used. Because the fertility of *E. albidum* when pollinated by *E. propullans* is higher than that of the latter in the reverse cross, there would be more F_1's and thus more opportunities for backcrosses in the general populations of *E. albidum* than in those of *E. propullans.* The pollinating insects also prefer flowers of *E. albidum*, Banks learned. If the F_1 produces no offshoot, as suggested by the plant raised to flower from a presumed hybrid seed (see below) then the F_1's would be hard to recognize in a population of *E. albidum* and the backcrosses would often pass undetected.

Because of the near total sterility of conspecific crosses in *E. propullans*, when fruits are occasionally found on plants of *this species* these are assumed to result from pollination by *E. albidum*, at least in the great majority of cases. The author undertook to verify this interpretation in practice by collecting and growing seeds from wild plants of *E. propullans.* Seven seeds were collected in 1980, 44 in 1981, and 48 in 1982, from four different localities, not attempting to keep separate the seeds of different plants within one locality. Germination and subsequent attrition are shown in Table 1.

Germination took place the first year when it did occur; it varied from 0-69% per pot and 8-59% per locality. Attrition of the seedlings was very great, perhaps influenced by the unnatural environment. Most of the seedlings were very weak and brittle, and some broke off accidentally when weeding the pots. By 1988 only two plants produced leaves, a 11% survival rate for the 1981 seedlings, the best year of the three. Presumably the rest of the plants are dead, although some may be dormant. For a short time in the winter of 1987-88 and possibly that of 1986-87 there was improper cold protection for the pots which may have permitted some losses.

Table 1

Year collected	1980	1981			1982		
No. seeds per pot	7	17	14	13	16	16	16
No. seedlings							
first year	1	2	7	9	6	2	0
Second year	1	2	6	6	6	2	0
Third "	1	2	6	5	6	2	0
Fourth "	1	1	3	2	6	**3**	0
Fifth "	0	1	3	**3**	0	1	0
Sixth "	0	0	2	2	0	0	0
Seventh "	0	0	2	0			
Eighth "	0						

The bold face underlined numbers in Table 1 indicate years when more seedlings appeared than were present the year before. In the example in the fourth column one cannot tell if the additional plant was dormant the preceding year or if it was produced by division of one of the two existing bulbs. Leaf widths the year before were 15 and 20 mm, and the next year they were 9, 25, and 33 mm. The 9 mm leaf does not fit the growth pattern and its bulb may have been dormant. In the second example of increase in number, the third plant must have been produced by the division of one of the two original bulbs. The three leaves measured 15, 16, and 25 mm wide, so presumably the smallest two are the products of that division. Bulb division in non-flowering plants never occurs in *E. propullans* it is common in *E. albidum*. Therefore the occurrence of such a division in a plant raised from seed from an *E. propullans* plant is evidence of the hybrid nature of the former plant.

Only one plant has bloomed, in its sixth year, one of the two in the double-underlined numeral 2 in the third column of 1981. Probably an F_1 hybrid, its leaf tips were inrolled, as in *E. propullans*; its whitish tepals were 15 mm long, a length intermediate between those of the two species, but it bore no trace of an offshoot, the major feature of *E. propullans* .

Most transplanted bulbs leafed out regularly, but sometimes they lay dormant for one or two years. In four cases bulbs were dormant for one year after transplanting. In one instance a bulb was dormant for two consecutive years after having leafed out its first year; and in the case of a plant of *E. propullans* that bloomed in 1984, producing two bulbs from one in the process, both were dormant the following year and leafed out the next. Dormancy after flowering did not occur in the seven other examples noted. The causes of dormancy are unclear but probably include available moisture and amount of stored food. Mycorrhizal fungi probably aid in the nutrition.

A few figures on multiplication of bulbs are available from this work. All bulbs were planted in 1980. The bulb increase is based on leaf count only. Five bulbs of *E. albidum* increased to 21 in 1985 and 1986, dropped to 15 in 1987, none in 1988. Of *E. propullans*, one set of three became 8 in 1985 and 1986, 2 in 1987, none in 1988. Another set of three produced 13 by 1986, then dropped to zero. A single bulb remained so until 1986 when there were two, then none. The abrupt decreases are probably due to failure to re-pot in 1985 and in 1986 to a failure to sink the pots deeply enough when they were moved. The results suggest that under good conditions *E. propullans* could nearly hold its own with *E. albidum* in vegetative reproduction.

The growth pattern of *E. propullans* in which the flowering bulb produces a second bulb but the non-flowering one remains single was nicely illustrated. In one example three bulbs planted in 1980 produced one flowering and two non-flowering bulbs in 1981, then three and one in 1982, three and four in 1983, and three and seven in 1984. Then the sequence was interrupted by dormancy or death of some of the bulbs. Non-flowering bulbs never divided.

Several colonies of *E. propullans* have been established at the University of Minnesota Landscape Arboretum at Chanhassen, Minnesota. These were started with plants taken from a site near Kenyon in Goodhue County. Three of the colonies are relatively isolated from any other species of *Erythronium* in the garden. Fruits and seeds on plants of these three might

reasonably be presumed to have resulted from pollination within their colonies, and thus to be examples of true seed production by *E. propullans*. Fruits are rare. The one collected contained a single seed which did not germinate. Two others were lost to animals.

Literature Cited

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